

REMARKS

In the Office Action¹, the Examiner took the following actions:

objected to the specification;

objected to claims 4, 6-8, 11, and 13;

rejected claim 9-15 under 35 U.S.C. § 112, second paragraph;

rejected² claims 1-4 and 6 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,190,911 ("Gofuku"); and

rejected claim 5 under 35 U.S.C. § 103(a) as being unpatentable over Gofuku in view of U.S. Patent No. 4,504,323 ("Arai").

Applicant has amended claims 4, 5, 8, 9, 11, 12, canceled claims 6 and 13, and added new claims 25 and 26. Claims 16-24 stand withdrawn and thus claims 1-5, 7-12, 13-15, 25, and 26 remain under examination.

Regarding the Amendments to the Specification

Applicant has amended the specification in response to the Examiner's comments at page 2 of the Office Action. In particular, Applicant has amended the title to disclose "SEMICONDUCTOR DEVICE AND METHOD OF MANUFACTURING THE SAME USING IMPLANTED ELECTRICALLY INACTIVE IMPURITIES." In addition, Applicant has amended the specification to recite "Group IV-A" where appropriate in the body of the Applicant's specification. Applicant has also amended the specification to correspond to the claims.

¹ The Office Action contains a number of statements reflecting characterizations of the related art and the claims. Regardless of whether any such statement is identified herein, Applicant declines to automatically subscribe to any statement or characterization in the Office Action.

² Although the Examiner indicate that claim 1-6 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Gofuku at page 4 of the Office Action, it appears that the Examiner intended to reject only claims 1-4 and 6 based on his comments at page 6 of the Office Action.

Applicant, however, respectfully traverses the Examiner's allegation of additional informalities at page 2 of the Office Action. The Examiner contends that the use of "entirely implanting" renders the subject matter disclosed in the specification and recited in claim 9 indefinite. Id. Applicant respectfully disagrees.

"Acceptability of the claim language depends on whether one of ordinary skill in the art would understand what is claimed, in light of the specification." M.P.E.P. § 2173.05(b). One of ordinary skill in the art would understand the exemplary embodiments shown in, for example, Figs. 1C and 3B of Applicant's specification. Accordingly, Applicant's specification supports the allegedly indefinite claimed subject matter and neither the specification nor the subject matter recited in claim 9 is "indefinite."

In light of the amendments to the specification and remarks, Applicant considered the Examiner's comments at page 2 of the Office Action addressed and requests that the Examiner withdraw his objection to the specification.

Regarding Applicant's claim amendments

Applicant has amended claims 4, 5, 8, 9, 11, 12. Claims 4, 5, 8, 11, and 12 are amended to correct minor informalities and typographical errors. In addition, claims 4, 5, 8, and 11 are amended in response to the Examiner's comments and suggestions at pages 2-3 of the Office Action. Claims 6 and 13 are canceled, rendering the objection to these claims moot. Claim 7 depends from claim 5 and claim 5 is amended in a manner consistent with the Examiner's comments at page 2. Based on the amendments to claim 4, 5, 8, 11, and the cancellation of claims 6 and 13, Applicant considers the Examiner's claim objections discussed at pages 2-3 of the Office Action

addressed, and requests that the Examiner withdraw the objection to claims 4, 6-8, 11, and 13.

Regarding the rejection under § 112, second paragraph

Applicant respectfully traverses the rejection of claims 9-15 under 35 U.S.C. § 112, second paragraph. As discussed above, “one of ordinary skill in the art would understand what is claimed, in light of the specification.” Applicant has, however, amended claim 9 in order even more clearly define the claimed subject matter. Applicant requests that the Examiner withdraw the rejection of claims 9-15 under 35 U.S.C. § 112, second paragraph.

Regarding the rejections under 35 U.S.C. § 103(a)

Applicant respectfully traverses the rejection of rejected claims 1-4 and 6 under 35 U.S.C. § 103(a) over Gofuku. No *prima facie* case of obviousness has been established.

To establish a *prima facie* case of obviousness, three basic criteria must be satisfied. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify a reference or to combine references. Second, there must be a reasonable expectation of success. Third, the prior art reference (or references when combined) must teach or suggest all of the claim elements. See M.P.E.P. § 2143. Moreover, the requisite teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in Applicant’s disclosure. See *In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991). See M.P.E.P. § 706.02(j).

Claim 1 recites, for example, “entirely implanting electrically inactive first impurity to one main surface of a semiconductor substrate.” Gofuku fails to teach at least this element recited in claim 1. Moreover, there is no motivation or suggestion disclosed by Gofuku to “entirely implant[] electrically inactive first impurity to one main surface of a semiconductor substrate.”

Gofuku discloses “fabricating a semiconductor device having a wiring part connected, via an opening portion formed in an insulating layer on a semiconductor region.” Gofuku, claim 1. Gofuku further teaches “depositing a first layer of the polycrystalline semiconductor over said opening portion of said semiconductor region.” Id. In addition, Gofuku teaches a “first impurity” is injected into the first layer “to convert at least a part of the polycrystalline semiconductor of said first layer . . . into an amorphous state.” Id. A second impurity is then injected into the first layer including “a desired region” to form the desired region with a high impurity concentration. Id. A metal or metal silicide is deposited to use the region as a contact portion. Id.

In other words, Gofuku teaches forming a region within a layer formed in an opening portion of the semiconductor substrate. The region within the layer is injected with first and second impurities in order to form contact portions.

Gofuku however, fails to teach or suggest the claimed “entirely implanting electrically inactive first impurity to one main surface of a semiconductor substrate,” (emphasis added) as recited in claim 1. Instead, Gofuku only teaches implanting first and second impurities in a region within a layer formed in an opening portion of the semiconductor substrate. Accordingly, Gofuku fails to teach or suggest each and every element recited in claim 1 and claim 1 is allowable for at least this reason.

Moreover, claim 1 recites implanting an "electrically inactive impurity" to the entire surface layer portion of a semiconductor substrate before the semiconductor substrate is heat-treated, regardless of which kinds of materials used for the surface layer portion of the semiconductor substrate. More specifically, the "electrically inactive impurity" is implanted not only to an active region (semiconductor device portion) such as an nMOSFET region and a pMOSFET region, where a transistor is formed, but also to an inactive region, i.e., a device separation region (insulation portion).

Such implantation allows different materials, which are used for the surface layer portion of the semiconductor substrate forming a device pattern, to have uniform absorption coefficient, thereby preventing the increase of a thermal stress caused by uneven heat application, and improving light absorption efficiency of the surface layer portion of the semiconductor substrate. As a result, it is possible to reduce the optical irradiation energy necessary for activating, by heat treatment, impurities which are implanted to the surface layer portion of the semiconductor substrate in a later process and have an electrically-active predetermined conduction type.

In contrast, Gofuku teaches ion implantation wherein not only an electrically inactive element but also an element having an electrically-active predetermined conduction type is implanted as a first impurity. For example, independent claim 1 of Gofuku, cited by the Examiner, recites ion implantation wherein an element having an electrically-active predetermined conduction type, such as gallium (Ga), indium (In), which belong to group III, or phosphorus (P), arsenic (As) and antimony (Sb), which belong to group V, is implanted to a semiconductor layer as a first impurity. Also, independent claim 4 of Gofuku recites ion implantation wherein as an element having

an electrically-active predetermined conduction type, one of arsenic (As), antimony (Sb) and bismuth (Bi), which belong to group V, is implanted to a semiconductor layer as a first impurity.

In exemplary embodiments disclosed by Applicant in, for example, Figs. 1C, 2A, 2B, 3B, and 3C, P, As, Sb and Bi are n-type elements which belong to group V, and if such elements are implanted to the semiconductor layer, a pMOSFET cannot be formed in the region. Likewise, Ga and In are p-type elements which belong to group III, and if these elements are implanted to the semiconductor layer, an nMOSFET cannot be formed in the region.

Gofuku does not disclose a teaching or suggestion of implanting an "electrically inactive impurity" to the entire or almost the entire surface layer portion of a semiconductor substrate in order to uniformly improving the light absorption efficiency of the surface layer portion of the semiconductor substrate, regardless of kinds of materials used for the surface layer portion of the semiconductor or the function of each region. Moreover, Gofuku does not disclose a suggestion or motivation to combine the elements taught by the reference in the Examiner's proposed manner. Instead, Gofuku is intended to implant impurities to the opening portion mainly for forming a contact plug which is connected to an electrode of a semiconductor device provided on the surface of the semiconductor substrate. See Gofuku, col. 1, lines 12-14 ("the connection of the semiconductor device with the wiring is improved.")

Therefore, the light absorption efficiency of the region the impurities are implanted is different from that of the region the impurities are not implanted. Thus, Gofuku fails to provide a motivation or suggestion of implanting an "electrically inactive

"impurity" to the entire or almost the entire surface layer portion of a semiconductor substrate in order to uniformly improving the light absorption efficiency of the surface layer portion of the semiconductor substrate, regardless of kinds of materials used for the surface layer portion of the semiconductor or the function of each region.

Accordingly, no *prima facie* case of obviousness is established with respect to claim 1 based on Gofuku because the reference fails to teach or suggest each and every element recited in claim 1. In addition, there is no motivation or suggestion disclosed by Gofuku to combine the elements taught by the reference in the Examiner's proposed manner. The rejection of claim 1 under 35 U.S.C. § 103 must be withdrawn. Claims 2-4 and 6 depend from claim 1 and are allowable over Gofuku at least due to their dependence.

Applicant respectfully traverses the rejection of claim 5 under 35 U.S.C. § 103(a) as being unpatentable over Gofuku in view of Arai. Claim 5 depends from claim 1 and thus incorporates each and every element recited in claim 1.

As set forth above, Gofuku fails to teach or suggest "entirely implanting electrically inactive first impurity to one main surface of a semiconductor substrate," as recited in claim 1 and required by claim 5. Arai teaches "equipment and a method for annealing semiconductors," (col. 1, lines 11-12), but also fails to teach at least this element recited in claim 1 and required by claim 5. Accordingly, no *prima facie* case of obviousness is established for claim 5 based on the combination of Gofuku and Arai. Accordingly, Applicant requests that the Examiner reconsider and withdraw the rejection of claim 5.

Conclusion

New claims 25 and 26, although of different scope, recites similar elements as claim 1 and are allowable over Gofuku or Arai, either alone or in combination, for reasons similar to those set forth above with respect to claim 1.

In view of the foregoing amendments and remarks, Applicant respectfully requests reconsideration and reexamination of this application and the timely allowance of the pending claims.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

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